THURSDAY, APRIL 29, 1897.

THE LIFE AND WORK OF CHARLES PRITCHARD.

Charles Pritchard, D.D., F.R.S., F.R.A.S., F.R.G.S., late Savilian Professor of Astronomy in the University of Oxford. Memoirs of his Life. Compiled by his daughter, Ada Pritchard. With an account of his theological work by the Right Rev. the Lord Bishop of Worcester; and of his astronomical work by his successor, Prof. H. H. Turner, F.R.A.S. Pp. viii + 322. (London: Seeley & Co., 1897.)

THE mere fact that the name of the late Prof. Pritchard is most widely known in connection with his astronomical researches, is in itself no uncertain sign of the energy and capacity of the man, for, as he himself stated, he did not really begin his astronomical work until he was seventy years of age. There are, however, other sides of his career for which he is little less worthy of grateful remembrance, exhibiting him, as they do, in the light of a pioneer in more than one important movement.

We therefore welcome the present volume, compiled by those who knew him best, giving a brief and interesting account of his life and work, which, it may be remarked, extended over nearly the whole of the century (1808–1893).

In a charming bit of autobiography, Prof. Pritchard tells the story of his schooldays, and of his struggles, ambition, and success as a schoolmaster. So far as one can judge, his early education was of the type then common, save for a short period during which he attended a private school kept by one John Stock, of Poplar, whose methods appear to have been far ahead of his time. The instruction of schoolboys in geometrical drawing, practical surveying, and the use of physical apparatus, was then (1822) no common undertaking, and this practical work seems to have influenced Pritchard very largely. It is at least certain that his mind was first seriously turned towards astronomy by a collection of Ferguson's models and astronomical instruments, which he had the privilege of studying at this "stirring school."

After a brilliant career at Cambridge, he entered a wider field as an educationist. Having been appointed to the mastership of the newly-founded Stockwell Proprietary Grammar School, he expounded his plans at the opening of the school, and only a few years ago he stated that "with the experience of half-a-century superadded, I can say with sincerity that had I now to form a scheme of education for a large school, it would be on the very same lines as those enunciated in my inaugural address." Suffice it to say that the main intention of his methods was the development of the *habit of thinking*, and as a step to its proper cultivation he proposed to introduce a well-furnished laboratory for the serious study of natural phenomena. He therefore claims to have been a successful pioneer in a most important branch of education. The sincerity of his convictions was afterwards proved when his energies were transferred to the Clapham Grammar School, which eventually passed entirely into his own management and proprietorship; not only did he actually establish the proposed laboratories, but he even went so far as to provide a swimming-bath and an observatory. While submitting to the system of examinations, Pritchard remained unconvinced of their utility, and he stated in 1886 that "the time will come when the competitives will be found to be intellectually and educationally suicidal."

Many of the pupils of the Clapham School have since become famous in various walks of life, and, among others, Dr. Bradley, the present Dean of Westminster, speaks of the great originality and success of the master's methods. Sir George Grove, another distinguished pupil, tells us in this volume how "geography became a reality," and the origin of the Palestine Exploration enterprise may be traced to the special attention given to that country at the Clapham School. One of the late Professor's favourite maxims, reiterated during his career as a schoolmaster, was "Whatever you do, do it as well as you can," and his whole life is a witness of his endeavour to act as he preached.

Pritchard's interest in astronomy took no practical turn until he had the means to add an observatory to his school, the most important part of the equipment being a fine transit instrument purchased at the close of the Exhibition of 1851. For private reasons the school was given up in 1862, and the observatory was removed to the new home at Freshwater, Isle of Wight. At this time Pritchard's repute as an amateur astronomer was so well established that he was elected Secretary to the Royal Astronomical Society, and within a few years he occupied the presidential chair. He took a very active part in the proceedings of the Society, and we have it on the authority of Prof. Turner, one of the present Secretaries, that his official connection with the Society has left lasting impressions on the conduct of its affairs.

The comparative retirement of the life at Freshwater ended in 1870, when Pritchard was appointed to the Savilian professorship. As Prof. Turner points out, he received this appointment rather on account of the man he was than for any conspicuous astronomical work which he had previously done, though, as subsequent events proved, he had only lacked the opportunity of doing justice to his observational ability. His association with the Astronomical Society here stood him in good stead, for he had given little evidence of his power except in ways of which the Society alone could take note, and his appointment was largely due to the representations of some of the more prominent Fellows.

The observatory, which was the scene of Pritchard's future triumphs, was at this time a very small one, but the authorities were soon persuaded to provide a 12-inch equatorial, and Dr. De la Rue's gift of his splendid instruments being made about the same time, an entirely new observatory was erected. The possibility thus opened for photographic work induced Pritchard to style the establishment "The New Savilian Observatory for Astronomical Physics at Oxford." As a matter of fact, however, the spectroscope has practically never been used in the observatory, so that in view of the meaning now attached to "astronomical physics," the observatory has lost the right to the name which Pritchard proudly gave it.

Practical instruction in astronomy was never greatly in demand at Oxford, hence nearly the whole strength of the small staff was available for research purposes and

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especially in two directions, as all the world knows, success was complete. By the use of the wedge photometer, Pritchard raised stellar photometry to the dignity of an exact science, and by the employment of photographic methods he investigated the parallaxes of a large number of stars with results which are probably among the most trustworthy ever obtained in this branch of astronomy.

Another epoch in Pritchard's astronomical career commenced with his offer to take part in the work of the international photographic star chart. Such an undertaking, at his advanced age, was characteristic of him; and the fact that he successfully initiated the work, and left everything in order at the time of his death, illustrates the methodical way in which he set about it.

The successful issue of the various undertakings at Oxford was largely due, as Pritchard himself was always anxious should be known, to the zeal of his assistants, Messrs. Plummer and Jenkins, by whom most of the actual observations were made.

Prof. Turner has succeeded in weaving together an admirable account of Pritchard's astronomical work, but it may be remarked that all reference to his connection with the work of the Committee on Solar Physics has been omitted.

A hitherto unpublished account of Pritchard's observations of the total solar eclipse of 1860 is included in Prof. Turner's story, and though these were overshadowed by De la Rue's magnificent photographic results, it is evident that they were carried out with the forethought and skill which marked all his work.

The selection of correspondence between Pritchard and some of his great contemporaries has, on the whole, been judiciously made, and all concerned in the preparation of the memoirs are to be congratulated on the production of a volume which will be prized by all who knew Pritchard, and one which is at the same time of sufficient interest to command the attention of a much wider public.

WATER AND ITS PURIFICATION.

Water and its Purification. By Samuel Rideal, D.Sc. Pp. xii + 292. (London: Crosby Lockwood and Son, 1897.)

THE author of this work describes it on the title-page as "a handbook for the use of local authorities, sanitary officers, and others interested in water supply." It is thus admittedly a book which is designed more for the general reader than for the engineer, the chemist, or the bacteriologist. That this is so we have further evidence in the preface, where we read that—

> "The closing of polluted wells, and decisions on new supplies, are now, however, in the hands of the general public, who, and their elected representatives, thus need to become acquainted with the results of the progress made during the last few years in bacteriology and knowledge of the causation of disease."

The book deals with the characters of different kinds of natural water, animal and vegetable impurities, the storage, filtration and distribution of water, the softening and purification of water, and lastly its analysis and the interpretation of results. On reading the book one finds that the author has not been able to refrain from including a large amount of technical detail, which is, however, treated too superficially to be useful to the serious student of the subject, and which must be of little or no use to the general reader. One cannot help wondering, for example, what sort of hazy notion the general reader will obtain from Figs. 61A-63, which show a colony of typhoid bacilli, and the typhoid bacilli themselves with and without flagella, the former called "spider" forms. The author is careful to inform the reader, on p. 266, that "the *size* of organisms is recorded in micro-millimetres = $\frac{1}{1000}$th of a millimetre commonly abbreviated μ''", but avoids recording either the size of organisms which are figured in the book, or the magnification to which they have been subjected, except in one case where the magnification happens to have been included in the descriptive letter-press copied with the figure from another book.

It is equally objectionable to place together in one plate, objects requiring differing degrees of magnification, as in Fig. 13, which exhibits in a single view a gigantic cyclops, spores of moulds, a zooglæa mass of bacteria, &c. Such figures may be well suited for advertisements of filters in order to show up the horrors of drinking water *au naturel*, but must prove somewhat misleading to the reader who obtains his first ideas of such objects from this book. On p. 256 the reader is informed that the flagella of bacteria "should be looked for by careful staining with iodine, fuchsine or other reagent." It would be advisable for any one who wishes to see these curious appendages of bacteria to select the "other reagent" referred to, for the employment of those named would be quite inadequate for his purpose. On p. 257 the author falls into the common error of supposing that aerobic organisms "are incapable of existing in absence of air"; as a matter of fact, when deprived of free oxygen they can lie dormant for very long periods of time, and wait for its advent as a signal for the renewal of their activity.

It is a little curious that an author who desires to inform his readers on such up-to-date topics as the staining of the flagella of bacteria, "spider-forms" of typhoid bacilli, and the latest methods of examining a sample of water for typhoid and cholera, should lay such stress on the history and properties of "the divining-rod." In the midst of a very useful *résumé* of facts bearing on the movements of water in various strata, on subsoil-water, line of saturation, "faults" and artesian wells, the author offers the following rather startling advice to the "local authorities and others" who may be in search of underground water. Instead of advising them to consult an engineer or geologist, as one would expect from the geological treatment of this part of his subject, we read on p. 77—

> "It is worth while for any one who has occasion to seek for underground water, before going to the expense of boring, to employ *first* (the italics are the author's) a 'water-finder,' and at the same time to invite a scientific authority to test the process in detail without bias, as the practical success seems sufficient, if not to shadow a new law, like the discovery of the Röntgen rays, yet by explanation to put this peculiar power in a position where it could be more largely useful and less hesitatingly accepted."

From the account given of a certain experiment with the divining-rod, the unknown power seems to act even

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